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SOLAR/1045-78/12

# Monthly Performance Report

MONTECITO PINES

DECEMBER 1978



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## U.S. Department of Energy

National Solar Heating and  
Cooling Demonstration Program

National Solar Data Program

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## MONTHLY PERFORMANCE REPORT

### MONTECITO PINES

DECEMBER 1978

#### I. SYSTEM DESCRIPTION

The Montecito Pines site is an apartment complex in Santa Rosa, California. It consists of one instrumented unit containing eight apartments. Each apartment has approximately 864 square feet of conditioned space. Solar energy is used for space heating and preheating domestic hot water (DHW). The solar energy system which serves the 8-apartment unit has an array of flat-plate collectors with a gross area of 950 square feet. The array faces 22 degrees west of south at an angle of 45 degrees to the horizontal. Water is the transfer medium that delivers solar energy from the collector array to storage and to the space heating and hot water loads. Freeze protection is provided by drain down. Solar energy is stored underground in a 2000-gallon insulated tank. City water is circulated through a heat exchanger in the storage tank for preheating before entering a gas-fired boiler which supplies DHW on demand. When solar energy is insufficient to satisfy the space heating load, the gas-fired boiler provides auxiliary energy for space heating. The system, shown schematically in Figure 1, has four modes of solar operation.

Mode 1 - Collector-to-Storage: This mode activates when the collector plate temperature exceeds the storage temperature by 17°F and terminates when a temperature difference of 3°F is reached. Collector loop pump P1 is operating.

Mode 2 - Storage-to-Space Heating: This mode activates when there is a space heating demand and the temperature at the top of the storage tank is 105°F or higher. Space heating pump P2 is operating and mode diversion valves V1 and V2 divert the flow to the heat exchanger in the storage tank and bypass the gas-fired boiler.

Mode 3 - Auxiliary Space Heating, DHW Preheating: This mode activates when there is a space heating demand and the temperature at the top of the storage tank is less than 105°F. Space heating pump P2 is operating and mode diversion valves V1 and V2 direct the flow through the gas-fired boiler and bypass the heat exchanger in the storage tank.

Mode 4 - DHW Preheating: This mode activates when there is a demand for DHW. Incoming city water passes through the heat exchanger in the storage tank on the way to the gas-fired boiler which supplies hot water, on demand, to the apartments.

#### II. PERFORMANCE EVALUATION

##### INTRODUCTION

The solar energy system operated continuously during December. Average daily solar radiation was well above the long-term December average while

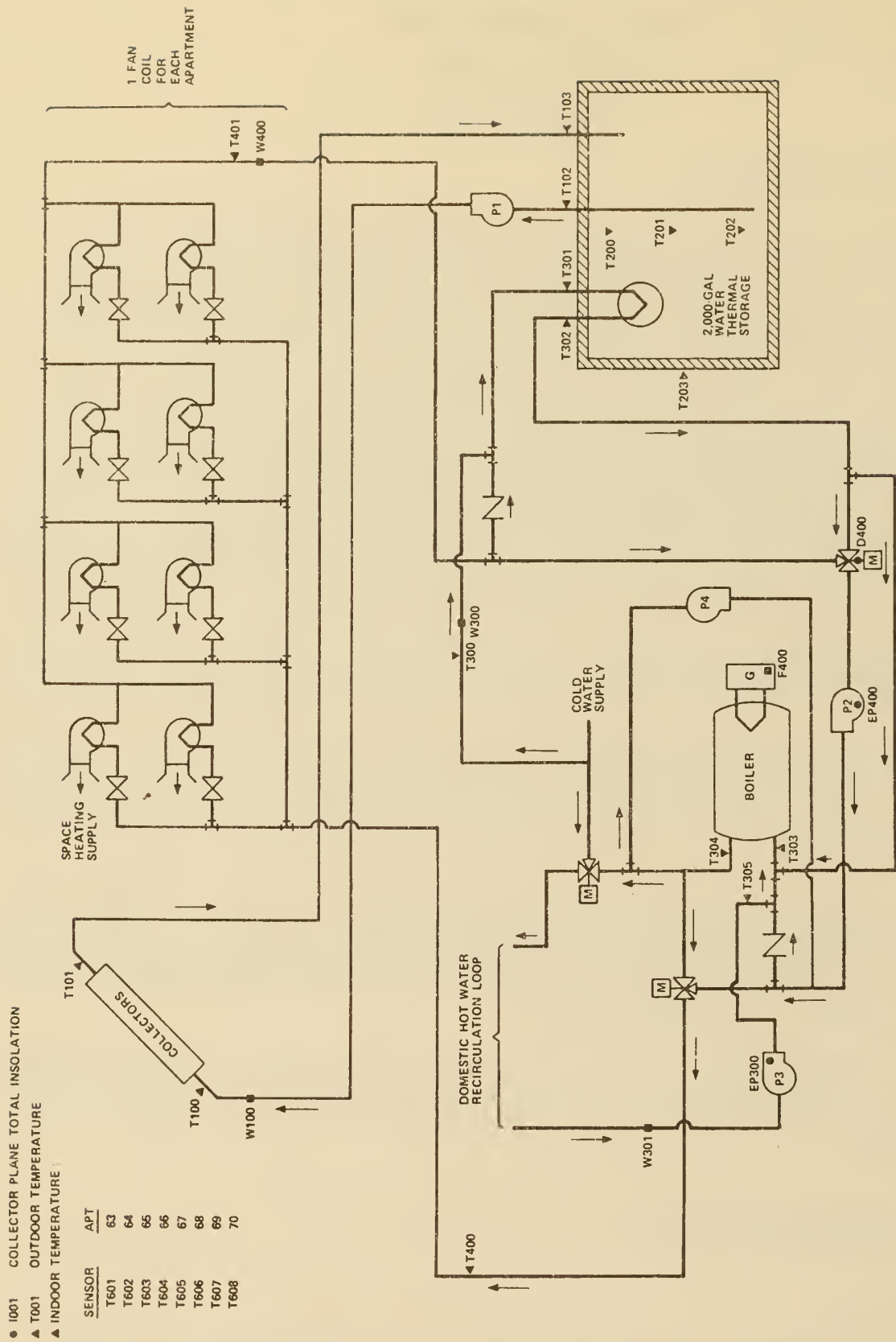


Figure 1. MONTECITO PINES APARTMENTS SOLAR ENERGY SYSTEM SCHEMATIC

average ambient temperature was well below the long-term average for December. Storage average temperature declined gradually during the month of December and the storage average temperature for December was four degrees less than the November monthly average. Approximately equal amounts of solar energy were applied to the DHW and space heating loads in December with the result that solar energy satisfied a significant portion of the DHW load and a small portion of the space heating load.

## WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 34.9 million Btu for a daily average of 1186 Btu per square foot. This was above the estimated average daily solar radiation for this geographical area during December of 928 Btu per square foot for a plane facing 22 degrees west of south with a tilt of 45 degrees to the horizontal. The average ambient temperature during December was 41°F as compared with the long-term average for December of 48°F.

## THERMAL PERFORMANCE

Collector - The total incident solar radiation on the collector array for the month of December was 34.9 million Btu. During the period the collector loop was operating, the total insolation amounted to 31.4 million Btu. The total collected solar energy for the month of December was 9.8 million Btu, resulting in a collector array efficiency of 28 percent, based on total incident insolation. Solar energy delivered from the collector array to storage was 8.4 million Btu. Energy loss during transfer from the collector array to storage was 1.4 million Btu. This loss represented 14 percent of the energy collected. Operating energy required by the collector loop was 0.56 million Btu.

Storage - Solar energy delivered to storage was 8.4 million Btu. There were 6.5 million Btu delivered from storage to the DHW and space heating subsystems. Energy loss from storage was 1.7 million Btu. This loss represented 20 percent of the energy delivered to storage. The storage efficiency was 80 percent: This is calculated as the ratio of the sum of the energy removed from storage and the change in stored energy, to the energy delivered to storage. The average storage temperature for the month was 102°F.

DHW Load - The DHW subsystem consumed 2.6 million Btu of solar energy and 4.3 million Btu of auxiliary thermal energy (equivalent to 5.4 million Btu auxiliary fossil fuel energy) to satisfy a hot water load of 6.0 million Btu. The solar fraction of this load was 43 percent. The DHW subsystem consumed a total of 0.70 million Btu of operating energy, none of which was chargeable to the solar energy system. A daily average of 322 gallons of DHW was consumed at an average temperature of 134°F delivered from the tank.

Space Heating Load - The space heating subsystem consumed 2.5 million Btu of solar energy and 37.6 million Btu of auxiliary thermal energy (equivalent to 47.0 million Btu auxiliary fossil fuel energy) to satisfy a space heating

load of 30.0 million Btu. The solar fraction of this load was 8 percent. Losses from the space heating subsystem were 10.1 million Btu. The space heating subsystem consumed a total of 2.2 million Btu of operating energy, none of which was chargeable to the solar energy system.

## OBSERVATIONS

Extreme stability has masked the performance of the solar energy system over the past two months. Operational incident solar energy has averaged 90 percent of total incident solar energy; solar conversion efficiency has averaged 14 percent and collector efficiency has averaged 28 percent. Month-to-month variation for these parameters is less than 1 percent. Losses between the collector array and storage declined from 17 percent in November to 14 percent in December. This rate of loss is on the high side but is not unreasonable.

Approximately 5.0 million Btu of solar energy were applied to the DHW and space heating loads in both November and December. The allocation between loads was significantly different however: In November, two-thirds of the solar energy was applied to the space heating load and one-third to the DHW load; in December, approximately equal amounts of solar energy were applied to the DHW and space heating loads. The governing factor in the division of solar energy between the DHW and space heating loads in this system is the storage tank temperature. Assuming a demand for both DHW and space heating, increasing amounts of available solar energy will be applied to the DHW load as the storage tank temperature declines.

## ENERGY SAVINGS

The solar energy system provided a total fossil fuel energy savings of 8.5 million Btu at an expense of 0.56 million Btu of electrical energy. The DHW subsystem provided a fossil fuel energy savings of 4.4 million Btu. The space heating subsystem contributed a fossil fuel energy savings of 4.2 million Btu.

## III. ACTION STATUS

Sensor problems exist in the DHW recirculation loop and with the gas usage totalizer. A site visit by IBM and Boeing has been scheduled for January.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT SITE SUMMARY

SOLAP/1045-78/12

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978

SANTA ROSA, CA

SITE/SYSTEM DESCRIPTION:  
MONTECITO PINES IS AN APARTMENT COMPLEX WITH EIGHT INSTRUMENTED UNITS. THE SOLAR ENERGY SYSTEM PROVIDES SPACE HEATING AND DOMESTIC HOT WATER. THE COLLECTION STORAGE LOOP USES WATER FOR THE ENERGY TRANSFER AND STORAGE MEDIUM. WATER FOR DOMESTIC HOT WATER USE PASSES THROUGH A HX IN THE STORAGE TANK AND THEN THROUGH A GAS FIRED BOILER IN THE DHW RECIRC. LOOP. WATER FOR SPACE HEATING CIRCULATES THROUGH THE STORAGE TANK HX OR THROUGH THE GAS FIRED BOILER AND IS AVAILABLE TO INDIVIDUAL APARTMENTS ON DEMAND.

### GENERAL SITE DATA:

INCIDENT SOLAR ENERGY 34.033 MILLION BTU  
COLLECTED SOLAR ENERGY 36771 RTU/SQ. FT.  
AVERAGE AMBIENT TEMPERATURE 0.782 MILLION BTU  
AVERAGE BUILDING TEMPERATURE 1.298 RTU/SQ. FT.  
FCS SOLAR CONVERSION EFFICIENCY 41 DEGREES F  
FCS OPERATING ENERGY 0.15  
TOTAL SYSTEM OPERATING ENERGY 3.455 MILLION BTU  
TOTAL ENERGY CONSUMED 65.606 MILLION BTU

### SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	5.077	30.015	N.A.	35.080
SOLAR FRACTION USED	42	2.497	N.A.	14
SOLAR ENERGY USED	2.582	2.106	N.A.	5.079
OPERATING ENERGY	0.704	37.603	N.A.	3.455
AUX. THERMAL ENERGY	4.324	N.A.	N.A.	41.066
AUX. ELECTRIC FUEL	N.A.	47.004	N.A.	N.A.
AUX. FOSSIL FUEL	5.405	0.000	N.A.	52.458
ELECTRICAL SAVINGS	0.000	4.162	N.A.	-2.555
FOSSIL SAVINGS	4.303	0.563	N.A.	0.464

### SYSTEM PERFORMANCE FACTOR:

\* DENOTES UNAVAILABLE DATA  
@ DENOTES NULL DATA  
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT  
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978.  
SOLAP/0004-78/12

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT SITE SUMMARY

SANTA ROSA, CA

SOLAR/1045-78/12

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978

SITE/SYSTEM DESCRIPTION:  
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### GENERAL SITE DATA: INCIDENT SOLAR ENERGY

#### COLLECTED SOLAR ENERGY

AVERAGE AMBIENT TEMPERATURE  
AVERAGE BUILDING TEMPERATURE  
ECSS SOLAR CONVERSION EFFICIENCY  
ECSS OPERATING ENERGY  
TOTAL SYSTEM OPERATING ENERGY  
TOTAL ENERGY CONSUMED

36.854 GIGA JOULES  
41.7576 KJ/SEC.  
10.221 GIGA JOULES  
116.040 KJ/SEC.  
18 DEGREES C  
15 DEGREES C  
0.585 GIGA JOULES  
3.645 GIGA JOULES  
60.200 GIGA JOULES

### SUBSYSTEM SUMMARY:

LOAD	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
SOLAR FRACTION	6.306	31.666	N.A.	37.958
SOLAR ENERGY USED	43	2.634	N.A.	14
OPERATING ENERGY	2.724	2.317	N.A.	5.258
AUX. THERMAL ENG	0.742	29.672	N.A.	3.645
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	44.274
AUX. FOSSIL FUEL	5.703	49.589	N.A.	N.A.
ELECTRICAL SAVINGS	0.000	0.000	N.A.	55.343
FOSSIL SAVINGS	4.529	4.390	N.A.	-0.585
		7.563		8.030

### SYSTEM PERFORMANCE FACTOR:

\* DENOTES UNAVAILABLE DATA  
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N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT  
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,  
SOLAR/0004-78/18

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT

### ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978

SANTA ROSA, CA

SOLAR/1745-78/12

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	HEAT LOSS TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTION MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	1.556	51	0.319	NUT	0.022	NUT	0.122
2	1.564	45	0.364		0.022		0.163
3	1.567	44	0.323		0.023		0.116
4	1.820	46	0.280		0.029		0.094
5	*	*	*		*		*
6	1.640	41	0.317		0.022		0.159
7	1.575	41	0.272		0.022		0.147
8	1.304	36	0.250		0.022		0.127
9	1.070	40	0.134		0.021		0.124
10	1.295	44	0.123		0.025		0.141
11	0.868	47	0.123		*		*
12	*	*	*		*		*
13	1.305	45	0.208		0.023		0.128
14	1.470	45	0.288		0.021		0.140
15	1.258	42	0.204		0.022		0.130
16	1.474	44	0.204		0.022		0.143
17	0.099	40	0.104		0.023		0.138
18	0.672	37	0.083		0.023		0.125
19	1.468	36	0.246		0.023		0.130
20	1.361	38	0.252		0.023		0.135
21	1.333	39	0.248		0.023		0.130
22	1.430	36	0.310		0.023		0.174
23	0.080	37	0.179		0.015		0.164
24	0.259	37	0.083		0.009		0.321
25	0.481	37	0.067		0.003		0.217
26	0.300	36	0.063		0.000		0.244
27	0.075	39	0.060		0.014		0.078
28	0.886	40	0.060		0.010		0.155
29	0.551	36	0.095		0.010		0.104
30	1.507	33	0.142		0.024		0.142
31	1.434	37	0.284		0.023		0.142
SUM	34.033	-	6.471	N.A.	0.555	N.A.	-
AVG	1.127	41	0.209	N.A.	0.018	N.A.	0.145
NBS ID	0001	N113			0102		N111

\* DENOTES UNAVAILABLE DATA.

@ DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT COLLECTOR ARRAY PERFORMANCE

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978  
SANTA ROSA, CA SOLAR/1045-78/12

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	1.556	1.467	0.475	50	0.305
2	1.564	1.458	0.486	50	0.311
3	1.567	1.467	0.458	60	0.292
4	1.830	1.714	0.546	50	0.298
5	*	*	*	*	*
6	1.640	1.502	0.420	48	0.256
7	1.575	1.472	0.403	47	0.256
8	1.304	1.289	0.355	49	0.254
9	1.070	0.887	0.278	51	0.284
10	1.295	1.103	0.387	55	0.294
11	0.868	0.708	0.228	57	0.262
12	*	*	*	*	*
13	1.305	1.245	0.421	60	0.322
14	1.470	1.375	0.455	61	0.310
15	1.258	1.154	0.420	57	0.338
16	1.474	1.385	0.420	54	0.292
17	1.099	0.900	0.300	45	0.300
18	1.468	1.384	0.461	46	0.314
19	1.360	1.218	0.370	49	0.260
20	1.391	1.306	0.423	52	0.272
21	1.433	1.357	0.423	52	0.295
22	1.480	1.350	0.421	41	0.246
23	1.258	1.081	0.241	40	0.080
24	1.481	1.310	0.404	39	0.172
25	1.309	1.000	0.023	41	0.000
26	1.075	0.785	0.077	41	0.000
27	1.086	0.785	0.122	41	0.312
28	1.551	0.426	0.122	41	0.242
29	1.507	1.431	0.447	43	0.297
30	1.424	1.239	0.419	52	0.291
31					
SUM	24.023	21.426	9.782	-	-
AVG	1.127	1.014	0.316	50	0.280
NPSID	0001		0100		N100

\* DENOTES UNAVAILABLE DATA.  
 0 DENOTES NULL DATA.  
 N.A. DENOTES NOT APPLICABLE DATA.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT STORAGE PERFORMANCE

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978  
SANTA ROSA, CA SOLAR/1045-78/12

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.416	0.310	0.010	107	0.800
2	0.403	0.364	0.000	107	0.843
3	0.403	0.323	0.001	108	0.804
4	0.473	0.280	0.126	109	0.981
5	*	*	*	*	*
6	0.369	0.310	-0.013	105	0.807
7	0.342	0.272	-0.012	104	0.820
8	0.285	0.250	-0.018	103	0.849
9	0.215	0.124	-0.020	103	0.802
10	0.221	0.253	0.018	105	0.732
11	0.158	0.123	-0.016	102	0.674
12	*	*	*	*	*
13	0.367	0.208	0.080	103	0.784
14	0.309	0.298	0.024	108	0.813
15	0.305	0.204	-0.025	106	0.881
16	0.375	0.204	-0.001	108	0.787
17	0.000	0.051	-0.001	102	0.000
18	0.000	0.103	-0.017	98	0.822
19	0.000	0.246	0.056	103	0.765
20	0.321	0.252	0.012	104	0.820
21	0.330	0.248	0.000	106	0.872
22	0.369	0.310	-0.001	106	0.811
23	0.205	0.170	-0.003	104	0.850
24	0.071	0.083	-0.011	99	0.766
25	0.016	0.067	-0.048	94	0.692
26	0.000	0.063	-0.063	97	0.230
27	0.236	0.060	-0.053	89	0.000
28	0.106	0.085	-0.123	80	0.813
29	0.393	0.142	-0.000	82	0.720
30	0.377	0.142	-0.150	88	0.744
31	0.377	0.284	-0.012	104	0.722
SUM	8.361	6.471	0.104	-	-
AVG	0.270	0.200	0.006	102	0.707
NRS ID	0200	0201	0202	-	N108

\* DENOTES UNAVAILABLE DATA.  
 @ DENOTES NULL DATA.  
 N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM  
MONTHLY REPORT  
HOT WATER SUBSYSTEM

SOLAR/1045-78/12

SANTA ROSA, CA

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR. OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FUEL MILLION BTU	ELECT SAVINGS MILLION BTU	FOSSTL SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.170	21	0.025	0.023	0.127		0.124	0.000	0.000	64	126	281
2	0.182	34	0.072	0.023	0.126		0.105	0.000	0.000	63	135	362
3	0.126	0	0.015	0.023	0.140		0.184	0.000	0.000	63	137	209
4	0.1	42	0.057	0.023	0.13		0.171	0.000	0.000	63	136	231
5	0.158	*	*	*	*		*	*	*	*	*	*
6	0.170	42	0.067	0.023	0.103		0.120	0.000	0.000	63	132	297
7	0.145	42	0.072	0.023	0.162		0.160	0.000	0.000	61	130	430
8	0.232	52	0.126	0.022	0.123		0.160	0.000	0.000	61	131	414
9	0.228	25	0.133	0.023	0.140		0.175	0.000	0.000	62	135	274
10	0.216	28	0.123	0.022	0.142		0.17	0.000	0.000	63	132	387
11	0.178	*	*	*	*		*	*	*	*	*	*
12	0.179	46	0.082	0.023	0.05		0.181	0.000	0.000	63	137	325
13	0.146	40	0.069	0.024	0.145		0.143	0.000	0.000	61	137	246
14	0.232	25	0.125	0.023	0.104		0.160	0.000	0.000	61	137	213
15	0.100	25	0.103	0.022	0.125		0.143	0.000	0.000	62	134	220
16	0.184	50	0.095	0.023	0.114		0.174	0.000	0.000	60	133	315
17	0.227	43	0.095	0.023	0.145		0.155	0.000	0.000	60	135	369
18	0.237	51	0.120	0.023	0.150		0.145	0.000	0.000	58	134	378
19	0.169	40	0.068	0.023	0.144		0.155	0.000	0.000	58	134	321
20	0.201	44	0.088	0.023	0.168		0.235	0.000	0.000	58	136	267
21	0.169	43	0.083	0.023	0.114		0.137	0.000	0.000	57	134	273
22	0.169	46	0.087	0.022	0.110		0.121	0.000	0.000	57	131	267
23	0.159	42	0.067	0.022	0.168		0.148	0.000	0.000	57	132	275
24	0.184	34	0.063	0.022	0.110		0.136	0.000	0.000	58	133	218
25	0.167	41	0.060	0.022	0.125		0.161	0.000	0.000	57	132	275
26	0.147	44	0.065	0.022	0.145		0.181	0.000	0.000	57	133	218
27	0.195	43	0.085	0.022	0.130		0.173	0.000	0.000	57	132	441
28	0.170	43	0.142	0.022	0.186		0.232	0.000	0.000	57	135	433
29	0.276	40	0.112	0.023	0.186		0.232	0.000	0.000	57	135	433
30	0.276	40	0.112	0.023	0.186		0.232	0.000	0.000	57	135	433
SUM	5.077	-	2.582	0.704	4.324	N.A.	5.405	0.000	4.303	-	-	0003
AVG	0.193	43	0.083	0.023	0.120	N.A.	0.174	0.000	0.139	60	134	322
NBS	0302	N300	0300	0303	0301	0305	0306	0311	0313	N305	N307	N308

\* DENOTES UNAVAILABLE DATA.  
# DENOTES NULL DATA.  
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM  
MONTHLY REPORT  
SPACE HEATING SUBSYSTEM

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978  
SANTA ROSA, CA  
SOLAR/1045-78/12

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR. OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER. ENERGY MILLION BTU	HEAT LOSS MILLION BTU	NET ELECT. FUEL MILLION BTU	NET ELECT. FUEL MILLION BTU	ELECT. ENERGY SAVINGS MILLION BTU	Fossil Energy Savings MILLION BTU	PLUG TEMP DEG. F	Amb. TEMP DEG. F
1	0.627	21	0.172	0.071	0.700	N.A.	0.875	0.000	0.875	70	51
2	0.809	20	0.183	0.071	0.864	N.A.	1.070	0.000	0.876	68	45
3	0.781	26	0.166	0.071	0.912	N.A.	1.130	0.000	0.377	68	44
4	0.573	20	0.116	0.071	0.730	N.A.	0.912	0.000	0.103	64	46
5	1.371	*	0.209	0.071	1.400	N.A.	1.873	0.000	0.346	*	*
6	1.391	16	0.148	0.071	1.536	N.A.	1.920	0.000	0.347	66	41
7	1.427	17	0.106	0.071	1.603	N.A.	2.116	0.000	0.176	65	41
8	1.134	0	0.000	0.071	1.515	N.A.	1.904	0.000	0.300	65	40
9	1.022	14	0.127	0.071	1.107	N.A.	1.304	0.000	0.312	64	44
10	0.813	*	0.200	0.070	1.165	N.A.	1.457	0.000	0.300	64	47
11	0.726	11	0.085	0.071	0.946	N.A.	1.190	0.000	0.342	*	*
12	0.578	22	0.137	0.071	0.649	N.A.	0.810	0.000	0.329	65	45
13	0.756	14	0.117	0.071	0.982	N.A.	1.133	0.000	0.195	65	45
14	0.600	21	0.156	0.071	0.783	N.A.	0.979	0.000	0.360	63	43
15	0.827	0	0.000	0.070	1.230	N.A.	1.540	0.000	0.300	64	44
16	0.814	0	0.000	0.070	1.405	N.A.	1.756	0.000	0.300	64	44
17	0.968	7	0.096	0.071	1.080	N.A.	1.225	0.000	0.148	63	39
18	0.954	16	0.113	0.072	1.245	N.A.	1.556	0.000	0.140	63	39
19	1.093	0	0.000	0.071	1.100	N.A.	1.487	0.000	0.268	63	39
20	1.091	0	0.000	0.071	1.263	N.A.	1.570	0.000	0.120	63	37
21	1.055	0	0.000	0.071	1.520	N.A.	1.919	0.000	0.300	63	37
22	1.074	0	0.000	0.071	1.455	N.A.	1.897	0.000	0.300	63	37
23	1.110	0	0.000	0.071	1.500	N.A.	1.941	0.000	0.300	60	36
24	1.126	0	0.000	0.070	1.473	N.A.	1.941	0.000	0.300	60	39
25	1.119	0	0.000	0.069	1.392	N.A.	1.737	0.000	0.300	62	40
26	0.995	0	0.000	0.069	1.545	N.A.	1.930	0.000	0.300	62	40
27	1.131	0	0.000	0.071	1.585	N.A.	1.991	0.000	0.300	61	33
28	1.170	0	0.000	0.069	1.585	N.A.	1.991	0.000	0.300	61	33
29	1.170	0	0.000	0.069	1.585	N.A.	1.991	0.000	0.300	61	37
30	1.065	0	0.000	0.069	1.258	N.A.	1.570	0.000	0.300	61	37
SUM	30.215	-	2.497	2.106	37.603	N.A.	47.004	0.000	4.162	-	-
AVG	0.968	8	0.081	0.071	1.213	N.A.	1.516	0.000	0.134	64	41
NBS	0402	N400	0400	0403	0401	-	0410	0415	0417	N406	N113

\* DENOTES UNAVAILABLE DATA.  
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM  
MONTHLY REPORT  
ENVIRONMENTAL SUMMARY

SOLAR/1045-79/12

SANTA ROSA, CA

SITE: MONTECITO PINES  
REPORT PERIOD: DECEMBER, 1978

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAILY AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	1638	NOT	51	58	NOT	NOT	NOT
2	1646		45	59			
3	1650	APPLICABLE	44	60	APPLICABLE	APPLICABLE	APPLICABLE
4	1927		46	59			
5	*		*	*			
6	1727		41	48			
7	1658		41	47			
8	1467		40	40			
9	1031		40	51			
10	1362		44	55			
11	912		47	57			
12	*		*	*			
13	1374	APPLICABLE	45	60	APPLICABLE	APPLICABLE	APPLICABLE
14	1548		45	61			
15	1325		42	57			
16	1551		42	54			
17	1707		44	45			
18	1545		40	44			
19	1431		37	49			
20	1465		36	49			
21	1508		38	52			
22	1032		36	52			
23	272		37	41			
24	507		37	40			
25	326		37	40			
26	79		36	41			
27	922		30	41			
28	580		40	47			
29	1587		36	41			
30	1510		32	43			
31			37	52			
SUM	36771	N.A.	-	-	-	-	-
AVG	1186	N.A.	41	50	N.A.	N.A.	N.A.
NBS ID	0001		N112		N115	N116	

\* DENOTES UNAVAILABLE DATA.  
@ DENOTES NULL DATA.  
N.A. DENOTES NOT APPLICABLE DATA.



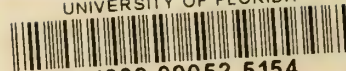








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